ITEM 686.802818M SOLID STATE MODULAR CONTROLLER ASSEMBLY-8 PHASE FTA WITH TIME BASE COORDINATION - NON INTERCONNECTED COORDINATION

TOD OPERATION AND SYSTEM COMMUNICATIONS

DESCRIPTION

The bidder shall furnish actuated controllers. Controllers to be provided shall utilize a micro-processor to implement the control logic with keyboard entry for the timing elements.

The controllers shall, as a minimum, meet all the requirements of the County of Monroe Special Requirements on Electronic Equipment, NEMA Standard TS1-1983 or latest revision, and the additional requirements specified in the following.

The CONTRACTOR shall furnish with each controller type delivered the following:

1) Two complete sets of extender cards to allow the controller unit modules to be operated outside of the controller housing for trouble shooting purposes.

2) One set, for each type of controller delivered, of non-volatile plug-in memory modules that test the processing unit, the volatile memory and the input and output circuits, and all applicable drawings. If the controller is self-testing, no modules will be required for this procedure. Diagnostic Prom shall be delivered as needed, one per each type controller.

3) Manuals, drawings, etc., stated in County of Monroe Equipment Specifications-Electronic Equipment.

4) Wrap around cable & connector assembly to front connections for testing including any "loop back" testing methods.

5) Any other communication jumpers, cables, and etc. needed for testing any part of the controller.

6) A "pod" with cable that plugs into the "CPU chip" socket that will interface with the Fluke 9010 so the unit can be tested by a 9010. Therefore, as part of this item in the specification the manufacturer will furnish all the memory maps and etc. so the Fluke can be programmed for testing the manufacturers equipment. The controller manufacturer will assist the County in programming the Fluke 9010.

S.S.CONTROLLER - 8 PHASE

MATERIALS

FUNCTIONAL REQUIREMENTS

The controller unit shall provide the features per phase, per ring and per unit as specified

in NEMA Standard TS1-1983 or latest revision.

Controllers shall be furnished as a normal eight phase dual ring units or as required by the sequence charts and intersection sheets and for bid requirements shown as "Alternate Phase Configuration".

The controller unit shall be capable of operating without internal modifications with loop, magnetic, pressure, sonic or radar detectors. Phases without actuation shall be skipped.

Manual operation shall be provided to service all phases and intervals in sequence as programmed. The yellow and red intervals shall be timed independently of manual operation.

Module functions shall be grouped in such a fashion as to allow a logical on-street analysis of controller failures that results in isolation of the particular failure to a particular module.

The interval in which normal cyclic operation will commence shall be programmable.

A recall function shall be provided, through keyboard entry, on the front panel for each phase to provide pedestrian timing, minimum green timing, maximum green timing, detector memory or non-memory and off.

The controller inputs and outputs shall be as defined in NEMA Standard TS1-1983 or latest revision, section 13.

The controller unit shall also contain an internal coordination function. This function shall, as a minimum, fulfill all of the operational requirements of the coordination section of this specification. Interface to this coordination function shall be by means of an "MS" connector or a "D" type separate from those used for the NEMA I/O functions. Interface levels used for synchronization (offsets), dial select and split select (if used) shall be ground true as defined by NEMA Standards TS1-1983 or latest revision. All necessary cycle, yield point and offset settings shall be entered via the front panel mounted keyboard.

REMOTE FLASHING

The controller shall be capable of providing "remote flashing" operation from a remote command. The "remote flashing" operation shall comply with the requirements of the N.Y.S. M.U.T.C.D. through a remote flash module or a programming feature of the Controller software. If a separate remote unit is needed, the unit must meet the requirements of Appendix A of this specification.

REAL TIME DISPLAYS

Data Entry and Display panel shall be provided with the capability of displaying at a minimum, current effective values of the following parameters, as programmed through the

keyboard.

a. phase of service
b. next phase to be serviced
c. internal (either normal operating interval or preempt)
d. presence of vehicle detector calls on each detector input
e. presence of pedestrian activation calls
f. coordination program values, outputs and timings

SPECIAL PREEMPTION INPUT

The main traffic control software of the controller shall include a special preemptor capability. The special preemptor will provide a method of rapidly terminating the phases of phases timing and selecting a special preempt phase of phases as phase next.

When, if one of the emergency vehicle preemptors is selected as a special type preemptor, the preempt signal will be applied to test Input B, the controller will terminate the phase(s) timing and set the preempt phase(s) designated in the configuration PROM as phase next. If the preempt phase is currently timing, it will be set to the beginning of initial green. Any phase timing a pedestrian movement when the preempt call is applied will be forced to pedestrian clearance. If the preempt call is applied during a yellow or red clearance interval, the existing phase next decision will be changed so that the preempt phase is phase next. If this causes a change in an overlap termination, the overlap will be properly terminated with its own yellow and red clearance period.

Once the controller reaches the preempt phase(s), any one of the following conditions can be programmed to occur:

a. Allow the controller to begin timing normally
b. Stop the controller in the initial green interval
c. Stop the controller in red transfer
d. Set the controller in a flash condition

A pre-empt condition of halting in red transfer of flash is selected by not programming a preempt phase next. With no preempt phase, the controller will terminate the phases timing and advance to red transfer. Once both timing groups reach red transfer, the controller can be programmed to an all-red flash using the controller outputs to flash the switchpaks, or to set voltage monitor FALSE causing a CMU flash condition.

Any of the above-mentioned preempt conditions remain effective until the preempt call is removed. Once the call is removed, the controller begins normal operation.

PRE-EMPTION

The controller unit shall provide a minimum of 6 priority/ non-priority preemption

sequences, in addition to 4 bus preemption sequences. This capability shall be a standard controller unit feature and shall not require additional modules or software.

PRIORITY/NON-PRIORITY PRE-EMPTOR DESIGN REQUIREMENTS

Each of the 6 priority/non-priority preemptors shall be capable of railroad, fire lane, or emergency vehicle preemption sequences.

Preemptor Call Priority

Preemptors shall be selectable as priority or non-priority. Lower numbered priority preemptors shall have highest priority and will override higher numbered priority preemptor calls. Additionally, priority preemptor calls shall override all non-priority preemptor calls. Non-priority preemptor calls shall be serviced in the order received.

Preemptor Call Memory

Each preemptor shall provide a locking and nonlocking memory feature for preemptor calls. If a preemptor is in the nonlocking mode and a call is received and dropped during the delay time, the preemptor shall not be serviced.

PRIORITY/NON-PRIORITY PREEMPTOR TIMING

The following preemptor timing features shall be provided for each of the priority/non-priority preemptor inputs.

Preemptor Timing Intervals

All preemptor timing intervals shall be programmable from 0-255 in 1-second increments to 0-25.5 in 1/10-second increments depending on the function. Preemptor duration time shall be programmable from 0-99 seconds in 1-second increments.

Delay Time

The delay time interval shall inhibit the start of the preemption sequence for a specified duration. This interval shall begin timing immediately after receiving a preemption call.

Inhibit Time

Inhibit time shall be the last portion of the delay time interval. During this time, phases that are not part of the preempt sequence shall be inhibited from service. The inhibit time shall begin when the remaining delay time equals the inhibit time.

Duration Time

Each preemptor shall provide a programmable duration time. This period shall control the minimum time that a preemptor shall remain active.

Minimum Times

Phases timing at the beginning of a preemption sequence shall remain in effect a minimum programmable time before advancing to the next sequential interval. Preemptor minimum times shall be programmable for the following intervals:

a. Green/Pedestrian Clearance
b. Yellow
c. Red

If the phase has been timing for longer than the programmed preemptor minimum time, the controller unit shall immediately advance to the next sequential interval. If a preemptor interval time has been programmed zero, the controller unit interval time shall be used.

Pedestrian Timing

If a phase is timing a walk interval at the beginning of a preemption sequence, then that phase shall advance immediately to pedestrian clearance. It shall be selectable to time the minimum pedestrian clearance through the yellow interval, or alternately advance immediately to yellow.

During preemption pedestrian indicators shall be selectable to be ON (solid don't walk), OFF (blank), or operational, during preemption.

Overlap Timing

Overlaps terminating or forced to terminate when a preemption sequence begins, shall time the preemptor minimum yellow and red clearance times. It shall also be selectable to terminate the overlaps at the beginning of preemption. Overlaps selected to terminate shall remain red through the remainder of the preemption sequence.

Track Clearance

Each preemptor shall provide a user-programmable green, yellow and red track clearance interval. These intervals shall begin timing immediately after the preemptor minimum red interval.

Up to 2 permissive phases shall be selectable as track clearance phases. During the track clearance period, the selected phases shall time the track clearance green, yellow and red intervals once, and then advance to the hold interval.

If track clearance phases are not selected, the track clearance intervals shall be omitted from the preemption sequence. If a track clearance interval time has been programmed zero, the controller unit interval time shall be used.

Hold

Any one of the following conditions shall be selectable to occur during the preemption hold interval:

a. Hold phase green
b. Limited phase service
c. All red
d. Flash

The hold interval shall begin immediately after track clearance. It shall remain in effect until the preemptor duration time and hold green times have elapsed and the preemptor call has been removed.

Hold Phases

Any valid phase(s), except a track clearance phase(s), shall be selectable as hold phases. If hold phases are not selected, the controller unit shall remain in all red during the hold interval.

If flash is selected for the hold interval, up to 2 permissive phases shall be selectable to flash yellow. The remaining phases shall flash red. Overlaps associated with the phases flashing yellow shall also flash yellow unless they have been forced to terminate; in which case they shall remain red. Flashing shall occur by controlling the appropriate load switch driver outputs.

Hold Timing

Each preemptor shall provide a user-programmable green, yellow and red hold interval. During the hold interval, the hold phase(s) shall operate normally (as outside of preemption), except that the minimum green interval time shall equal the hold green time.

At the completion of the hold green interval the controller unit shall time the hold yellow and red clearance intervals prior to transfer to the exit phases.

If any hold interval is programmed zero, the equivalent controller unit interval time shall be used.

Exit Phases

Up to 2 permissive exit phases shall be selectable to time after the preemption sequence has been completed. These phases shall serve as transition phases to return the controller unit to normal operation. Exit phases shall time their normal programmed interval times.

Additionally, it shall be possible to program exit calls on any of the phases in use. Phases programmed as exit phases shall be served first, while exit calls on the remaining phases shall be served in normal sequence.

PREEMPTOR LINKING

Preemptor linking shall permit complex preemption sequences. Preemptors 2 - 6 shall be capable of linking to higher priority preemptors. During preemptor linking, the lower priority preemptor shall call the higher priority preemptor upon terminating its preemption sequence.

PREEMPTOR ACTIVE OUTPUTS

Preemptor active outputs shall be provided for the 6 priority/ non-priority preemptors. The output shall be set to ON when the preemption sequence begins and shall remain ON for the duration of the sequence.

BUS PREEMPTOR DESIGN REQUIREMENTS

Four bus preemptors shall provide control of bus or other low priority vehicle preemption sequence. Bus preemptors shall have lowest priority and shall be overridden by all priority/non- priority preemptor calls.

Bus preemptor Calls

Preemptor call inputs 3-6 shall apply calls to the respective priority/non-priority preemptors and bus preemptors 1-4. A 1 PPS signal with a 50% duty cycle shall identify a bus preemptor call. Bus preemptor calls shall be capable of "preemptor call memory" (see page 4) and shall be served in the order received.

BUS PREEMPTOR TIMING

The following preemptor timing features shall be provided for each of the bus preemptors.

Bus Preemptor Timing Intervals

All bus preemptor timing intervals shall be programmable from 0-225 seconds in 1-second increments or 0-25.5 seconds in 1/10-second increments depending on the function.

Reservice Time

Reservice time shall control repeated service of the same bus preemptor. The reservice time interval shall begin at the end of a bus preemptor sequence. If a call is received before the reservice time has elapsed, the bus preemptor shall not be reserviced.

If reservice time has not been entered then all phases with a call when leaving the bus preemption sequence shall be serviced before the bus preemptor may be served again.

Delay and Inhibit Time

Each bus preemptor shall provide delay and inhibit time functions as stated in Delay Time & Inhibit Time on page 5.

Entrance Times

Bus preemptors shall provide the following entrance intervals:

a. Green/Pedestrian Clearance
b. Yellow
c. Red

These clearance intervals shall operate similar to the minimum time intervals described.

Hold Green

At the completion of the entrance red clearance, the bus preemptor shall advance to the hold green interval. During the hold green interval, up to 2 permissive phases shall be selectable to remain green. These phases shall remain green until the bus preemptor call has been removed and the hold green time has elapsed. At this point, the controller unit shall resume normal operation.

POWER INTERRUPTION

If a preemptor call is active when power is restored to a controller unit, the voltage monitor output shall be set to FALSE, placing the intersection in flash. Additionally, if external start is applied during a preemption sequence, the intersection shall be set to flash. Intersection flash shall remain in effect until the preemptor call has been removed and the preemptor duration time has elapsed.

PREEMPTOR STOP TIME

A separate input shall be provided to stop the timing of the current active preemptor. The preemptor timing shall not be stopped when the normal controller unit stop time inputs are applied. The preemptor stop time input shall normally be controlled by the conflict monitor unit.

PREEMPTOR INTERLOCK

A preemptor interlock output shall provide a safety interconnect between the controller cabinet and the preemptors. This output shall be TRUE (ground) when preemption is not used and FALSE (+24V through a 1K ohm resistor) when preemption is used. This output shall be connected to the conflict monitor (24V Monitor II input) whenever the controlled intersection requires preemption. This feature shall cause intersection flash whenever the controller unit has been removed, or has not been programmed for preemption.

TIME-BASED CONTROL/NONINTERCONNECTED COORDINATION

The controller unit shall include time based control. This capability shall be a standard feature and shall not require additional modules or software. (see appendix D)

CLOCK/CALENDAR

The controller unit shall provide a time-of-day (TOD) clock. The only required clock settings shall be the current time (hour, minute, and second) and date (month, day, and year). Day of week and week of year shall be automatically computed from the date setting. This clock shall be used for all time based control functions.

Clock Accuracy

The TOD clock shall use the power line frequency as a time base. When power is removed, the time shall be maintained by as crystal oscillator.

The oscillator shall maintain the time to within $\pm$ 0.005%, as compared to the Universal Mean Coordinated Time Standard. This accuracy shall be maintained over the NEMA Standard temperature range regardless of the number or rate of power failures.

The controller unit shall maintain the TOD clock during power outages of up to 30 days.

Time and Date Entry

Time and date information shall be entered in the controller unit through the following methods:

a. The controller unit keyboard
b. Transferred from another controller unit or computer
c. Updated via system communications

Leap Year and Daylight Savings Time

The TOD clock shall automatically compensate for leap year changes. Daylight savings time changes shall be selectable not to occur, or occur automatically as defined by law.

TIME BASED CONTROL

Program Format

Time based control shall utilize a yearly program format. The program shall provide 53 programmable weeks, each assignable to 1 of 10 week-programs. The first week of the year shall be defined as the week in which January 1, occurs. Each week-program shall be programmable by each day of the week, using any 1 of 16 specified day-programs.

Holidays

There shall be a minimum of 36 holiday or exception-day programs. Each holiday-program shall be assignable to occur on a specific month and day. Holiday-programs shall override the current day-program.

Each holiday-program shall be selectable to repeat the following year. If a holiday-program is not selected to repeat, then it shall be used once and then automatically deleted.

Program Steps

A minimum of 160 program steps shall be available for the day- programs. Each day-program shall be able to use any number of program steps. Program steps assigned to a day-program shall not have to be entered in any special sequence. Also, it shall be possible to add and delete steps from a program without affecting any other day-program.

Each of the 160 program steps shall permit selection of the following functions:

a. Day program assignment
b. Start time
c. Cycle/Offset/Split
d. Free
e. Flash
f. Dimming
g. Max 1, 2 or 3
h. Control of four Special Function outputs

The cycle/offset/split or free commands, selected by a program step, shall serve as the coordination program only when the controller unit is operating as a TOD master or operating in the noninterconnected coordination mode (time based).

Remaining program step functions shall take effect immediately when the program step becomes active.

Forced Program Step

It shall be possible to manually force any of the 160 programs steps to override the current program step. The forced step shall be entered from the keyboard and shall remain in effect until removed.

NONINTERCONNECTED COORDINATION - See Appendix D

Resync Time

When operating in the noninterconnected coordination mode, a programmable resynchronization time shall be used as the beginning time for all cycles. All cycles shall be reset to zero, each day, at this time.

Synchronization Point

The synchronization point, for the cycle selected by the current program step, shall be computed using the present time, resync time, and cycle length. The synchronization point shall occur whenever the present time is such that an even number of cycle length periods have occurred since the resync time. Computing the synchronization point based on event changes, or similar methods, shall not be accepted.

Time Reset

The controller unit shall include time reset input. This feature will reset the TOD clock to a predetermined time whenever the time reset input is True.

MODES OF INTERCONNECT

The coordinator shall be capable of operating with any of the following interconnect types:

a. Noninterconnected Coordination (time based)
b. Telemetry
c. Hardwired

The noninterconnected coordination mode shall also serve as a back up when using telemetry or hardwired interconnect.

The coordinator shall be compatible with a fixed time interconnect which provides the sync pulse superimposed on the offset lines. The coordinator shall also operate within an interconnected system using a separate sync line.

MASTER COORDINATOR

The coordinator shall output the coordination command, including sync. This feature shall permit the controller unit to be used as a time-of-day master in a hardwired interconnected

system.

REAL TIME DISPLAYS

During any interrogation and display of current values, the controller shall continue in uninterrupted operation.

Interconnect: Inputs to the Coordinator shall be ground true logic input for all coordination functions.

Coordination: The Coordination module shall provide for front panel keyboard programming of all timing and operating parameters. The front panel shall give a clear visual indication of the selected programs. It shall not be necessary to remove or change wires or contracts or to use any tools in making program selections or adjustments.

Range of timing adjustments for the cycle Modules shall be at least as follows:

TITLE	RANGE OF ADJUSTMENT (as a minimum)
Cycle Length (Cycle 1, 2, 3)	0 to 165 secs in 1 secincrements
Offsets (Inbound, Outbound,	0 to 165 secs in 1 sec Average increments or %
Permissive periods (End 1,	0 to 165 secs in 1 sec (Start 2, End 2, Start 3, End 3) increments or %
Force-Off Points (1, 2, 3)	0 to 165 secs in 1 sec increments or %

Selection Controls for the Display shall be as follows:

TITLE KEYBOARD POSITIONS

Cycle	Free, Cycle 1, 2, 3 System
Display Select	Offset, Local Cycle Elapsed

Indicators: Each display shall be capable of displaying:

a. Local Cycle (read out of local cycle elapsed in 1 second increments)
b. Cycle in effect
c. Offset in effect

d. Count-up to local offset in effect

The Display shall be capable of displaying:

a. Application of Hold (illuminated when controller is being held in the coordinated phase)
b. Active duration of Permissive Period 1
c. Active duration of Permissive Period 2
d. Active duration of Permissive Period 3
e. Active duration of Force-off 1
f. Active duration of Force-off 2
g. Active duration of Force-off 3

OPERATING REQUIREMENTS

Operative Characteristics: The Coordinator, in response to Master demand, shall provide the following minimum supervisory control over a local intersection Control Unit.

a. Automatic selection of any one of up to three cycle lengths 1, 2, 3
b. Automatic selection of any one of three offsets - Inbound (1), Outbound (2), or Average (3) - per cycle
c. Cycle and Offset selection shall be controlled by ground true as defined in NEMA TS-1983 at each discrete function input termination
d. Automatic release of full-actuated local Controller Unit from Master control for independent, (Free) full-actuated operation when arterial detectors are used. When arterial detectors are not used, call for Free shall result in independent semi-actuated operation of the local Controller Unit
e. Single permissive period and dual permissive periods in a single permissive period
f. Master Internal Time Clock
g. System program changes always implemented at Master Zero Point
h. Minimum of three splits per cycle
i. Must have phase omit capability by keyboard entry and omitting by software programming without external circuitry per cycle length

CYCLE LENGTH

Independently programmable as a minimum between 0 and 165 seconds, in a 1 second increment.

OFFSETS

Three per cycle independently programmable as a minimum between 0 and 165 seconds, in 1 second increments or 0 to 100 in one % increments.

FREE OPERATION

Means shall be provided for three remotely controlled Free operating modes:

a. Automatic selection when all Offset lines are de-energized
b. Direct interconnect selection through interconnect by assertion of Free switch input. Free operation shall continue as long as input is asserted regardless of other interconnect requirements.
c. Automatic selection when a particular offset and cycle combination are selected by the Master Control.

Free operation of the intersection controller will also be automatically initiated if a Master Control sync signal is not received.

PERMISSIVE PERIODS

The coordinator shall be equipped to provide Permissive Periods as follows:

Three Permissive Periods shall be fully programmable to start and end any 1 second or 1% increment of the cycle. During the first Permissive Period, the Coordinator will release the controller from the coordinated phase to service a Phase 2 Pedestrian or vehicle demand. If there is no demand for Phase 2, the controller shall continue to remain in Phase 1 until the second Permissive Period. The second and third Permissive Periods follow in time the first Permissive Period and are additional "windows" in the cycle during which the coordinator can be programmed to selectively respond to other than Phase 2 pedestrian or vehicle demands.

When a controller unit has yielded to a non-arterial phase, all successive phases with vehicle and/or pedestrian demand shall be served in the normal order of phases for that controller unit.

FORCE-OFFS

The coordinator shall be equipped to provide minimum of independent phase-related Force-Offs for all phases.

The Force-Off function shall cause the local Controller Unit to terminate right of way on the programmed phase. Force-Off command will not cause the right of way to terminate during the walk or pedestrian clearance interval.

Programming of Force-Off timing shall be accomplished directly by means of front panel keyboard.

Force-Offs shall be programmable to any 1 second or 1% increments of the selected cycle and shall be maintained until the green terminates.

OFFSET CHANGES

Offset changes shall be by dwell operation and shortway. Operation for shortway offset seeking shall be as follows:

a. The Coordinator shall seek a new offset in the shortest direction.
b. The rate of offset change shall not exceed 20 percent points per cycle.
c. A new offset shall never be more than 50% away from an existing offset and shall be attained in no more than three cycles.

CONSTRUCTION DETAILS

The controller unit shall consist of a main frame, suitable for shelf mounting, with printed circuit card cage and backplane to house and interconnect all operating modules.

Programming the controller shall be accomplished by establishing all timing intervals and selecting all modes of operation by means of adjustments which are directly accessible from the front of the controller. This would exclude portable type programmer/ display units. All programming shall be by means of front panel mounted keyboard. This keyboard shall employ discrete keys which give "tactile feedback" and visual evidence of excursion when exercised. The keyboard shall not be an integral part of the controller unit front panel, but shall be removable, in its entirety, from the front panel for service and/or replacement. A debounce circuit shall be provide for the keyboard.

A quarter turn "twist-lock" MS connector(s) of the MIL-C-26482 series shall be provided for interconnecting all inputs and outputs with their external control circuits and devices. All contacting connector surfaces shall be plated a minimum of 30 millionths inch gold over 5 ten thousandth inch nickel, except the coordination connector which may be a 25 pin "D" type, DBC-25S/DB-25S. If an MS type connector is to be used for the coordination connection it shall be an MS3116F20415. A (1) foot interface connector to connector harness will be supplied for each controller so as the JD connector for the "coordination function" can be interfaced with either type connector. (See Appendix B).

Indicators shall be as specified in NEMA Standard TS1-1983 or latest revision.

DESIGN

The controller shall be modular in design for ease of repair.

The controller shall feature a menu driven format which uses a front panel keyboard with a twenty (20) column by four (4) row liquid crystal display as a minimum.

The keyboard shall have tactile feedback so as to insure a positive input.

The main menu shall be in English/Traffic Engineering terminology for the major categories of programming data, where user selects the appropriate category and there is prompted for addition entries.

The LCD display shall have a minimum of four (4) adjustable contrast settings and E-L backlight to provide for easy to read displays under all lighting conditions.

Extensive monitoring capabilities shall be provided by dynamic displays. Over all and specific intersection timing shall be easily viewed by the user. Displays shall include error messages to help with fault isolation.

Data storage shall be accomplished by non-volatile EE PROM.

A battery back-up shall be provided for critical control "chips" during power failures. The battery shall be a lithium type with a thirty (30) day minimum rating, with a three (3) year life as a minimum.

A modem module or card shall be part of the controller so the unit can be up loaded/down loaded via voice grade telephone lines or interface with a personal computer, or communicate to a printer by a standard RS232 port and format. Program loading shall be accomplished via the front keyboard, down load from a Master, down load from a PC DOS or MS DOS compatible computer, down load from one controller to another or the data module transfer from one controller to another unit.

AUTOMATIC DIAGNOSTIC DURING NORMAL OPERATION

The following items will be checked automatically while the controller is running.

1. Prom test
2. Ram test
3. CPU test
4. EE Prom test

MECHANICAL REQUIREMENTS

MAIN FRAME

The main frame shall provide housing, mounting, and all necessary internal interconnection. The main frame shall be equipped and wired with a card cage and a backpanel with appropriate connectors to receive a full complement of plug-in modules. All plug-in modules shall be easily removable from the card cage without the use of special tools, or controller disassembly.

SIZE

Maximum dimensions of the main frame shall be:

Height 17"
Depth 13" (including connector protrusion)
Width 19"

FINISH

All exterior surfaces to the main frame shall be etched and painted if aluminum or primed with a zinc chromate printer and painted if a ferrous metal. Anodized surfaces shall be permitted.

MODULARITY

Modules shall be grouped in plug-in printed circuit board assemblies. All modules of similar function shall be interchangeable between all 4 and 8 phase controller unit housing furnished. This interchangeability shall be accomplished without the need for wiring changes.

ELECTRICAL REQUIREMENTS

POWER

The controller unit shall be designed for use on nominal 120 volt, (within a range of 95 to 135 volts) 60Hz single phase A.C.

POWER DISTRIBUTION

The main frame and card cage with backplane shall distribute all necessary operating power from the power supply module to all other modules of the controller unit. "Crowbar" type SCR surge circuits shall be provided to protect all components from power surges.

The power supply shall utilize a ferroresonant transformer for stability. Fuse protection shall be provided for the 115 AC input and the 24 VDC power output. The fuses will be located on the front of the controller.

PROTECTION

The main frame shall be provided with a fuse for the 120 volts, 60Hz A.C. supply to the unit and a fuse for the 24 volt D.C. external output from the unit.

SWITCHES AND CONNECTORS

The controller unit switches and connectors and any other components required for operation and adjustment of the controller unit shall be mounted on the front panels. All component parts and terminals shall be readily accessible when the phase modules are

removed for maintenance, testing and servicing.

CUSTOM CIRCUITS

The use of custom LSI integrated circuits in the controller unit is expressly prohibited.

ENVIRONMENTAL REQUIREMENTS

The actuated controller shall meet the environmental conditions required of control equipment as specified in NEMA Standard TS1-1983.

QUALITY ASSURANCE REQUIREMENTS

The actuated controller shall meet the following factory acceptance test and design approval test requirements in accordance with Section 6.1 of the Special Requirement specification. The contractor shall prepare all required test procedures and data forms for approval by the ENGINEER.

FACTORY ACCEPTANCE TESTS

The bidder or manufacturer shall conduct or cause to be conducted, as a part of the factory acceptance test procedure, environmental testing of all units delivered under this contract. The environmental test procedures to be followed shall be those of the transient voltage, temperature, low voltage and high voltage portions of the environmental tests specified in the NEMA Standards Publication for Traffic Control Systems TS1-1983 or latest revision.

The bidder or manufacturer shall furnish all data taken during these tests to the Engineer.

DESIGN APPROVAL TESTS

The design approval tests specified in NEMA Standard TS1-1983 or latest revision shall be performed for each type of controller supplied.

METHOD OF MEASUREMENT

Each actuated controller delivered and accepted by the Engineer will be measured as a single unit.

BASIS OF PAYMENT

Payment for each actuated controller will be made for the measured quantity as the contract price for each. The unit price shall include all labor, tools, materials, equipment and incidentals necessary to meet the specifications. Sixty-five (65) percent of the contract bid price shall be paid upon delivery. Thirty-five (35) percent shall be paid upon satisfactory functional testing by Monroe County after delivery. Functional testing shall be performed within ninety days from delivery.

APPENDIX A

FLASH CONTROL MODULE CABINET INTERFACE

The flash control module mating socket is mounted in the cabinet detector rack. A single position rack with mating socket is installed in cabinets that do not require detector racks. The single position rack is mounted on the right cabinet sidewall immediately under the top shelf.

Operational interface with the control cabinet is as follows:

Supply voltage is connected to pins A and B. +24VDC is supplied from the nema controller to pin B of the module. Logic ground input on pin A is connected to the nema controller logic ground output. Pins 1 and 10 are connected to the cabinet earth/chasis ground.

Flash command input on pin C requires a logic low true input for intersection go to flash command. This input is connected via the cabinet wiring to the RCU flash command output O RCU pin J1-47.

Pins D and E described as R1 and R2 last phase Red are connected, in the cabinet, to the nema controller phase red outputs which control the minor or cross street reds. In a single ring controller both of these inputs will be connected together in the cabinet mating socket.

Pin 1 from the module is connected to the nema controller "external minimum recall" input. Upon a "Flash Command" input on pin C a low true output will be generated on pin 1. This causes the nema controller to cycle through all phases used to the start of the side street red at which point the intersection will be placed in flash.

Relay K1 Common 1 pin 2 is jumped to pin B the +24 VDC connection to the module. During the module "no flash" condition K1 is de-energized feeding +24 VDC through to K1 NC1 pin X. Pin X on the cabinet connector is connected to 1-1A which connects +24 VDC during "no flash" to pin 4 of K100 relay which controls cabinet flash. The module causes a cabinet flash operation by disconnecting the +24 VDC to pin 4 of K100. When K100 de-energizes the cabinet is put in flash operation.

Pin 21 N.O. 2 on the module cabinet socket is connected to DT-5 which is the controller phase 1 green (which is normally the main street phase A). When the module outputs a flash command to the cabinet, K1 energizes. Pin 21 N.O. 2, is connected to K1 common 2, pin 22. The cabinet connection pin 22, is connected to pin N then thru diode CR2 to pin t. Pin t is connected in the cabinet to BT41 which is the controller stop time input terminal; therefore, when the module is calling for cabinet flash, the controller will be stopped timed in the beginning of phase 1 green.

The controller will then remain stop timed in phase 1 green while the intersection is in flash. Upon cessation of the external flash command, the intersection will resume automatic operation in phase 1 (Phase A) main street operation.

Outputs on pins 2-6 exist on the module but are not used in this cabinet application.

Relay connections are not identified as to a specific function on the module schematic. The module is designed to be flexible enough for application in various agency cabinet specifications.

APPENDIX D

NIC COORDINATION MODULE OR UNIT

The following NIC coordination module or unit shall be supplied as part of the bid. The module can be interchangeable with standard coordination or can be supplied as a stand alone unit or as part of the software program.

NONINTERCONNECTED COORDINATION REQUIREMENTS

Minimum weekly sequence of 7-day programs
- Start and stop date settings to enable selection of second (seasonal) week.

Minimum 20 programs of any number of program steps

Minimum program steps
- Each program step allows selecting:
  - Starting hour and Minute
  - One of six cycles
  - One of five offsets
  - One of four splits
  - Free
  - Flash
  - Alternate coordination program functions
  - Actuated coordination phase
  - Actuated coordination phase with walk rest
  - MAX 1/INH MAX
  - MAX 2
  - Phase omit to be applied to designated phases
  - MAX 2 operation
  - ON/OFF status of two undedicated outputs

Minimum 12 holiday programs that can override any program day
- Each holiday program allows selecting
  - Date to be effective

Program number (1-1) to be in effect
Perennial or one time operation

Desirable Programs:

Automatic daylight savings time adjustment
This feature can be disabled
Leap year adjustment

Displays:

Display of current time (hours, minutes, seconds), program in effect, day, and date
Down loading/up loading of NIC data base portable module.